

**IE 345 Engineering Economy (2019-2020 Fall)**

**HOMEWORK # 1**

**Due Date: 09/12/2019, at 16:00**

*We hereby declare that, the work we are submitting in this homework assignment is our own work.*

<b>Student ID</b>	<b>Name and Surname</b>	<b>Signature</b>

**Instructions:**

- Show all your work clearly in your handwriting in the spaces provided below each question.
- Submit your homework to the TA (Funda GÜNER) until the due date and time.

<b>GRADES</b>		
<b>Question no.</b>	<b>Total Points</b>	<b>Points Got</b>
<b>1</b>	<b>10</b>	
<b>2</b>	<b>10</b>	
<b>3</b>	<b>10</b>	
<b>4</b>	<b>5</b>	
<b>5</b>	<b>10</b>	
<b>6</b>	<b>10</b>	
<b>7</b>	<b>10</b>	
<b>8</b>	<b>5</b>	
<b>9</b>	<b>5</b>	
<b>10</b>	<b>10</b>	
<b>11</b>	<b>5</b>	
<b>12</b>	<b>10</b>	
	<b>100</b>	

1. Make a brief explanation for each terms below:

ROR, economic equivalence, capitalized cost, annual worth, MARR, capital recovery, salvage value, continuous compounding, effective interest, geometric gradient.

2. Find the present worth in year 0 at an interest rate of 15% per year for the following situation.

<b>Year</b>	<b>Cash Flow, \$</b>
<b>0</b>	-19,000
<b>1-4</b>	8,100

3. Calculate the net annual worth and future worth in years 1 through 10 of the following series of incomes and expenses, if the interest rate is 10% per year.

<b>Year</b>	<b>Income, \$</b>	<b>Expense, \$</b>
<b>0</b>	0	-2500
<b>1-4</b>	700	-200
<b>5-10</b>	2000	-300

4. What is the present worth of a \$50,000 debenture bond that has a bond coupon rate of 8% per year, payable quarterly? The bond matures in 15 years. The interest rate in the marketplace is 6% per year, compounded quarterly.

5. Income of part time instructor is \$500 per month in the average for  $3\frac{1}{2}$  years. Compute her/his future worth of the income (after the  $3\frac{1}{2}$  years) at an interest rate of 9% per year, compounded quarterly? (no interperiod-interest)

6. An engineer working in BOTAŞ have to perform a present worth analysis on natural gas line routings. It is possible to run the pumps underground or (outside) can be used. The installing the pumps underground is more expensive, but on the other hand it is more protected against damages that way. Perform the PW, FW and AW analysis for the engineer at 15% per year.

<b>Costs in (1000 TL)</b>	<b>Outside</b>	<b>Underground</b>
<b>Installation</b>	-250	-500
<b>Caused by damages (annual)</b>	-5	-3
<b>Routine maintenance (every 10 years)</b>	-25	-45
<b>Expected life, years</b>	15	20

7. The maintenance and operation (M&O) cost of front-end loaders working under harsh environmental conditions tends to increase by a constant \$1200 per year for the first 5 years of operation. For a loader that has a first cost of \$39,000 and first-year M&O cost of \$17,000, compare the equivalent annual worth of a loader kept for 4 years with one kept for 5 years at an interest rate of 12% per year. The salvage value of a used loader is \$23,000 after 4 years and \$18,000 after 5 years.



8. The maintenance cost of a public park occurs as periodic outlays of \$500 every year and \$1000 every 5 years. Calculate the capitalized cost of the maintenance using an interest rate of 8% per year.

9. Water damage from a major flood in a Midwestern city resulted in damages estimated at \$108 million. As a result of the claimant payouts, insurance companies raised homeowners' insurance rates by an average of \$59 per year for each of the 160,000 households in the affected city. If a 20-year study period is considered, what was the rate of return on the \$108 million paid by the insurance companies?

**10.** The alternatives are mutually exclusive and the MARR is 7% per year. Find the present worth of the alternatives and discuss the results.

	<b>A1</b>	<b>A2</b>	<b>A3</b>
First cost, \$	-100,000	-275,000	-500,000
Annual cost, \$ per year	-25,000	-10,000	-5,000
Revenue, \$ per year	60,000	60,000	55,000
Salvage value, \$	12,500	0	250,000
Life, years	10	15	$\infty$

**11.** According to Descartes' rule and Norstrom's criterion, how many  $i^*$  values are possible for the cash flow (CF) sequence shown?

Year	1	2	3	4	5
Net Cash Flow	+8000	-16000	-12500	+25000	-4000
Cumulative Cash Flow	+8000	-8000	-20500	+4500	+500

**12.** Use the cash flows below experienced by Beko house appliances. Use the ROIC and MIRR methods to determine the ROR value. The MARR is 8% per year, and any excess funds generated by the project can earn at a rate of 13% per year and disbursements are financed from outside with a rate of 7% per year.

Year	0	1	2	3
Net Cash Flow (1000)	+4000	-1000	-16200	+13600